Patent Claims

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1. An optical system, in particular projection exposure system for microlithography, in particular having a slot-shaped image field or non-rotational-symmetric illumination,

   a) having an optical element comprising at least one chamber that is sealed from atmospheric pressure and is enclosed by boundary surfaces and that has a fluid filling, wherein at least one of the boundary surfaces is exposed at least partially by illumination light;

   b) fluid source that has a fluid connection to the chamber via a fluid supply line; and

   c) control device for the pressure of the liquid filling;

   wherein

   the at least one enclosed chamber (5; 105, 105') is configured in such a way that a change in the fluid pressure inside the at least one chamber (5; 105, 105') results in a change in non-rotational-symmetric imaging properties of the optical element (1; 101) that have an n-fold symmetry relative to the optical axis of the optical element, where n is greater than 1.

2. The optical system as claimed in claim 1, wherein a change in the fluid pressure inside the at least one chamber (5; 105, 105') results in a change in the astigmatic imaging properties of the optical element (1; 101).

3. The optical system as claimed in claim 1 ~~or 2~~, wherein at least that region of the surfaces forming the boundary of the chamber (5) that is irradiated by illumination light is at least partially formed by an elastically deformable material (3, 4), the edge contour (9, 10) of the elastically deformable region being non-rotational-symmetric.

4. The optical system according to claim 3, wherein the edge contour (9, 10) has an n-fold symmetry relative to the optical axis of the optical element, where n is greater than 1.

5. The optical system as claimed in claim 4, wherein the edge contour (9, 10) is elliptically shaped.

6. The optical system as claimed in claim 4, wherein the edge contour has the shape of a polygon.

7. The optical system according to ~~one of claims 3 to 6~~ claim 3, characterized in that the elastically deformable optical medium (3, 4) is held in its edge region by a holding device (6, 11, 7, 12), the shape of the holding surface with which the optical medium (3, 4) is in contact with the holding device (6, 11, 7, 12) imposes the edge contour (9, 10) of the elastically deformable surface region.

8. The optical system as claimed in claim 7, wherein the optical medium is a pellicle (3, 4).

9. The optical system as claimed in claim 7, wherein the optical medium is a quartz plate.

10. The optical system as claimed in claim 7, wherein the optical medium is a CaF_2 plate.

11. The optical system as claimed in ~~one of claims 3 to 10~~ claim 3, wherein the optical medium has a reflecting coating.

12. The optical system as claimed in claim 1 ~~or 2~~, wherein at least one region of a surface of the surfaces forming the boundary of the chamber (105, 105') is irradiated by illumination light (148) and is formed by at least one rigid optical surface having different curvature in mutually perpendicular planes.

13. The optical system as claimed in claim 12, wherein the optical element (101) is formed from a combination of at least two optical components (127, 128) that each comprise at least one chamber (105, 105') that is sealed from atmospheric pressure and is enclosed by boundary surfaces, that has a liquid filling and that is irradiated by illumination light (148), the optical components (127, 128) having, at least in the region of one surface of the surfaces forming the boundary of the respective chambers (105, 105') in each case at least one optical surface having different curvature in mutually perpendicular planes; and wherein an independent control of the pressure of the liquid filling in the chambers (105, 105') assigned to the optical components (127, 128) is ensured by means of a control device (147).

14. The optical system as claimed in claim 13, wherein the optical element is designed so that, given equal pressure in the fluid filling in the chambers (105, 105') assigned to the optical components, it has essentially rotational-symmetric imaging properties.

15. The optical system as claimed in claim 12, wherein the optical element is designed so that, given equal pressure in the fluid filling in the chambers (105,

105') assigned to the optical components, it has astigmatic imaging properties.

16. The optical system as claimed in ~~one of claims 12 to 15~~ claim 12, wherein the optical surface having different curvature in mutually perpendicular planes is a surface of a cylindrical lens (130, 130').

17. The optical system as claimed in claim 16, wherein the cylindrical lens (130, 130') is a plano-convex cylindrical lens.

18. The optical system as claimed in ~~one of the preceding claims~~ claim 1, wherein the control device (22; 147) has a signal connection (23, 24, 25; 123, 124, 125) to a sensor arrangement (26; 126) that monitors the imaging properties of the optical element (1; 101) and/or the optical system, the control device (22; 147) impressing a pressure in the fluid filling as a function of the transmitted signal data of the sensor arrangement (26; 126).

19. The optical system as claimed in claim 18, wherein the sensor arrangement (26; 126) has a position-sensitive sensor.

20. The optical system as claimed in claim 19, wherein the position-sensitive sensor (26; 126) is a CCD array.

21. The optical system as claimed in ~~one of the preceding claims~~ claim 1, wherein the control device (22; 147) is designed so that it is capable of producing both underpressures and overpressures.

22. The optical system as claimed in ~~one of the preceding claims~~ claim 1, wherein the fluid is a gas.

23. The optical system as claimed in claim 22, wherein the fluid is a noble gas.

24. The optical system as claimed in ~~one of claims 1 to 21~~ claim 1, wherein the fluid is a liquid.